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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

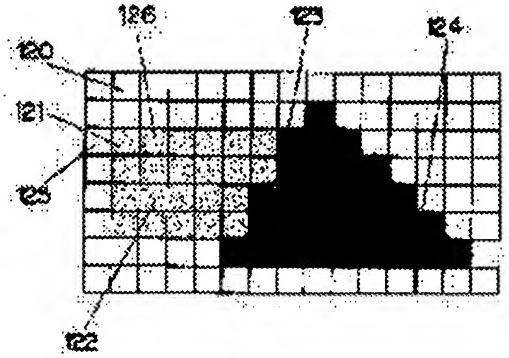
(72)Inventor : MORIMATSU HIROYUKI

(54) METHOD FOR PROCESSING IMAGE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an image processing method capable of improving the edge reproducibility of a binary image.

SOLUTION: In the image processing method of executing binary processing, a pixel 121 to be noted is determined, two adjacent pixels 125, 126 interposing the noted pixel 121 between them are determined, respective density differences between the noted pixel 121 and the two adjacent pixels 125, 126 are found out, and when at least one of two density differences is larger than a prescribed set point, the noted pixel 121 is determined as a pixel in an edge part. When both the density differences are less than the prescribed set point, the noted pixel 121 is determined as a pixel not in the edge part, and a threshold at binary processing when the noted pixel 121 is a pixel in the edge part is set up higher than a threshold at binary processing when the noted pixel 121 is not in the edge part.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] It is the image-processing approach which performs binary-ized processing to a multi-tone pixel, and generates a binary image. Determine an attention pixel and two contiguity pixels which adjoin said attention pixel and sandwich this attention pixel are determined. Search for each concentration difference of said attention pixel and said two contiguity pixels, and when said at least one concentration difference of said two concentration differences is larger than the predetermined set point, said attention pixel is made into the pixel of the edge section. When the thing [any] aforementioned concentration difference is smaller than the predetermined set point, said attention pixel is made into the pixel which is not the edge section. The image-processing approach characterized by setting up lower than the threshold at the time of the binary-ized processing in the case of being the pixel said whose attention pixel is not the edge section the threshold at the time of binary-ized processing in case said attention pixel is a pixel of the edge section, and performing binary-ized processing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is applied to a printer, a scanner, a copying machine, facsimile, etc., and relates to the image-processing approach which reproduces multiple-value image information as a binary image.
[0002]
[Description of the Prior Art] As one of the approaches which changes a multiple-value image into a binary image, the error diffusion method is known widely.
[0003] Drawing 5 is the block diagram showing the circuit which performs the conventional error diffusion method. The multiple-value data D of the attention pixel 121 which performs binary-ized processing from an image memory 100 in this drawing are read, and gamma amendment of is done to the multiple-value data according to the printing property of output equipment, such as a printer, with reference to the amendment data stored in the gamma amendment ROM 101. By the adder 102 of the error diffusion-process section 107, the error data E in this attention pixel 121 are added, and, as for multiple-value data D' of which gamma amendment was done, F=D'+E is outputted.
[0004] The data F of the attention pixel 121 to which error data were added are compared with the binary-ized threshold Th in a comparator 104, in F>=Th, binary-signal B="1" is outputted, and when it is F<Th, binary-signal B="0" is outputted. And binary-ized error E' at the time of binary-ized processing is computed as E'=F-B' by the subtractor 106 from this output.
[0005] Here, it is set to B'=Bx255 when input data is 256 gradation (0-255). It follows, for example, when the threshold of D= 230 and binary-izing is Th=128, it is B= 1, and as for the binary-ized error E, input multiple-value data are set to E=D-Bx255=230-1x255=-25. [of the output data after binary-izing]

[0006] In order for the predetermined error matrix Mxy to distribute this binary-ized error E in the weighting error computing element 105 to the data of a pixel processed after this, it is stored in the error memory 103, and is added to the multiple-value data of degree pixel with an adder 102, and propagation of error data is performed.
[0007] although [namely,] input multiple-value data are D= 230 in an example -- receiving -- binary-izing -- the comparison result of threshold Th=128 and the output data after binary-izing are 1, and since they are set to 255 in 256 gradation, the error of 25 produces them to 230 of the input multiple-value data D. Therefore, the error 25 over the input multiple-value data D= 230 is made into a binary-ized error, error distribution are carried out to the error memory 103 of an unsettled pixel with the weighting error computing element 105 using an error matrix, and this error is made to reflect in the binary-ized processing by subsequent pixels.
[0008] Here, an example of the error matrix Mxy used in the conventional error diffusion method is shown in drawing 6 .
[0009] In drawing 6 , the pixel shown by * is the present attention pixel 121, and suppose that binary-ized processing is performed to this pixel.

[0010] An error is distributed to degree unsettled pixel by the weighting multiplier (7, 1, 5, 3) which showed the error produced when this attention pixel 121 is made binary in this drawing. And it amends to the following input value which read the error allocation value stored in the error memory 103 when performing binary-ized processing of the attention pixel 121 shown by *, and was read from the image memory 100 using this error allocation value.
[0011] Thus, an error diffusion method is an approach of the binary-ized error produced in the case of binary-ized processing of a certain pixel being henceforth distributed to the binary--ization-processed pixel data, and pressing down the error of image data and the original multiple-value image data to min after binary-izing.
[0012]
[Problem(s) to be Solved by the Invention] In the image which performed binary-ized processing by such error diffusion method, the repeatability of the edge section of the image made binary poses a problem on the property to distribute an error to a perimeter pixel. That is, in the attention pixel 121, since a part of information on a surrounding pixel is added, dotage occurs in the edge section of an image.
[0013] As conventional approach about this technical problem, edge enhancement processing by a high-pass filter etc. is performed to the original multiple-value data, and the method of raising the shelf life of an edge is used.
[0014] However, since the new problem that filtering influences the whole image and image quality deteriorates occurs according to this, there is nothing for fundamental solution very much.
[0015] Then, this invention aims at offering the image-processing approach that improvement in the edge repeatability of the binary image after error diffusion process can be aimed at.
[0016]
[Means for Solving the Problem] In order to solve this technical problem, the image-processing approach of this invention Determine the attention pixel 121 and two contiguity pixels 125,126 which adjoin this attention pixel 121 and sandwich this attention pixel 121 are determined. Each concentration difference of the attention pixel 121 and two contiguity pixels 125,126 is searched for. When at least one concentration difference of two concentration differences is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. The threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section is set up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section, and binary-ized processing is performed.
[0017] It becomes possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section by this, and to aim at improvement in the edge repeatability of a binary image.
[0018]
[Embodiment of the Invention] It is the image-processing approach which invention of this invention according to claim 1 performs binary-ized processing to a multi-tone pixel, and generates a binary image. Determine the attention pixel 121 and two contiguity pixels 125,126 which adjoin this attention pixel 121 and sandwich this attention pixel 121 are determined. Each concentration difference of the attention pixel 121 and two contiguity pixels 125,126 is searched for. When at least one concentration difference of two concentration differences is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. The threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section It is the image-processing approach of setting up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section, and performing binary-ized processing. It has an operation of becoming possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section,

and to aim at improvement in the edge repeatability of a binary image.
[0019] Hereafter, the gestalt of operation of this invention is explained using drawing 4 from drawing 1. The block diagram showing a circuit for drawing 1 to perform the image-processing approach which is the gestalt of 1 operation of this invention, the explanatory view showing the pixel detected as the edge section in the image-processing approach that drawing 2 is the gestalt of 1 operation of this invention, the explanatory view showing a setup of the threshold in the binary-ized processing in the image-processing approach that drawing 3 is the gestalt of 1 operation of this invention, and drawing 4 are the flow charts which show the procedure by the image-processing approach which is the gestalt of 1 operation of this invention.
[0020] The multiple-value data D of the attention pixel 121 which performs binary-ized processing are read from an image memory 100, and gamma amendment of is done to the multiple-value data according to the printing property of output devices, such as a printer, with reference to the amendment data stored in the gamma amendment ROM 101 so that it may illustrate. After edge detection processing is performed by the edge detection processing section 108 in which, as for the multiple-value data of which gamma amendment was done, the attention pixel 121 detects whether it is the edge section, a threshold is determined in the threshold decision processing section 109 of the error diffusion-process section 107. Moreover, the error data in the attention pixel 121 are added by the adder 102.
[0021] The data of the attention pixel 121 to which error data were added are compared in the threshold and comparator 104 which were determined in the threshold decision processing section 109, and a predetermined binary signal is outputted. And the binary-ized error at the time of binary-ized processing is computed by the subtractor 106 from this output.
[0022] In order for the predetermined error matrix Mxy to distribute this binary-ized error in the weighting error computing element 105 to the data of a pixel processed after this, it is stored in the error memory 103, and it is added to the multiple-value data of degree pixel with an adder 102, and propagation of error data is performed.
[0023] Here, in the case of the binary-ized processing in the attention pixel 121, the edge detection processing section 108 is for this pixel to detect whether it is the edge section, and outputs the information on whether the attention pixel 121 is the edge section based on the multiple-value data in the contiguity pixel 125,126 of attention pixel 121 right and left. In addition, about the detection procedure of the edge section, it mentions later.
[0024] Moreover, since this attention pixel 121 is saved as the edge section when the attention pixel 121 is detected by the edge detection processing section 108 as the edge section in the attention pixel 121, the threshold decision processing section 109 sets up the threshold for binary-izing as for which a dot becomes is easy to be struck.
[0025] Next, detection of an edge and preservation are explained using drawing 2. The image of the multiple-value data which perform binary-ized processing in drawing 2 is shown, and this multiple-value data is expressed by the data of 256 gradation (0-255). And the 128 pixel concentration 123 and a pixel 124 make [a pixel 120 and the contiguity pixel 125 / concentration 0, the 121 pixel attention pixel 122, and the contiguity pixel 126] concentration 250 concentration of each pixel in this drawing.
[0026] Here, the pixels which should be detected as the edge section are the 121 pixel attention pixel 123 and a pixel 124, and are pixels which generate a dot and should save an edge by the image after binary[in this pixel]-izing. Moreover, the contiguity pixel 125 and the contiguity pixel 126 are pixels of the right and left which adjoin the attention pixel 121, and concentration is referred to in order to compute a concentration difference with the right-and-left pixel in the attention pixel 121 in the case of detection processing of an edge.
[0027] Next, detection of whether this attention pixel 121 is the edge section is explained. the concentration difference of the contiguity pixel 125 which is [data / of the attention pixel 121 / concentration] the contiguity pixel 125,126 on either side in D3 and the attention pixel 121 about the concentration data of D2 and the contiguity pixel 125 in the concentration data of D1 and the contiguity pixel 125 here, and the contiguity pixel 126 -- each, if DL and DR A concentration difference with the left contiguity pixel 125 in the attention pixel 121 and the concentration difference with the right

contiguity pixel 126 serve as DL=D1-D2DR=D1-D3, respectively. And when the fixed value S with this value is exceeded, the attention pixel 121 is detected as the edge section. That is, when either DL>S or DR>S is materialized, this attention pixel 121 is detected as the edge section.
[0028] Next, the dot generating control at the time of detecting the attention pixel 121 as the edge section is explained.
[0029] In the pixel detected as the edge section, edge repeatability improves by promoting generating of a dot according to concentration. And it is possible to promote generating of a dot by changing the threshold at the time of the binary-ized processing by the pixel detected as the edge section, and gathering the incidence rate of a dot.
[0030] Such processing is explained using drawing 3 . Here, drawing 3 (a) and (b) show the relation of ON/OFF of the dot by the concentration of image data and a setup of a threshold at the time of error diffusion process.
[0031] Generally, as shown in drawing 3 (a), the binary-ized threshold in the case of binary-izing by the conventional error diffusion is set about [middle] to 128 to the input concentration of 256 gradation, and is fixing this. However, with the gestalt of this operation, as shown in drawing 3 (b), a dot-on field is extended by lowering the binary-ized threshold in the pixel detected as the edge section to 96, it carries out that it is easy to generate a dot in this pixel, dot generating in the edge section is made [many], and edge repeatability is raised.
[0032] It explains referring to the flow chart of drawing 4 about such binary-ized processing. In drawing 4 , one line of the multiple-value data of an image which performs binary-ized processing is first stored in an image memory 100 (step s200), and the error data distributed to the pixel of this Rhine next are stored in the error memory 103 (step s210). And while reading the concentration data D1 of the pixel which performs binary-ization from the data for one line, adding the weighting error in this pixel and acquiring attention pixel 121 data, it changes into the amendment data corresponding to this pixel data from the gamma amendment ROM 101 (step s220).
[0033] Next, in the edge detection processing section 108, the concentration data D2 and D3 in the pixel of the right and left which adjoin the attention pixel 121 are acquired from an image memory 100 (step s230), and DL=D1-D2 and DR=D1-D3 which are the concentration difference of the concentration data D1 of the attention pixel 121 and the concentration data D2 and D3 of a right-and-left pixel are computed (step s240).
[0034] And the concentration differences DL and DR and the set point S which were acquired are compared (step s250), and from the set point S, when the concentration difference DL or the concentration difference DR is size, it detects this pixel as the edge section in the threshold decision processing section 109, and it performs a lower setup in a threshold as 96 (step s270). on the other hand -- both the concentration difference DL and the concentration difference DR -- although -- from the set point S, when it is smallness, a threshold is left 128 as fields other than the edge which is not the edge section (step s260).
[0035] Thus, after setting up a threshold, binary-ized processing by the error diffusion in this attention pixel 121 is performed (step s280), and processing by this pixel is ended.
[0036] And it judges whether the above-mentioned processing was completed to all the pixel of current Rhine (step s290). If it has not ended, it progresses to the following pixel and step s280 is performed from step (step s310) s220. Moreover, if it has ended, it judges whether the processing to all Rhine was ended (step s300), and the above processing will be repeated until it goes to next Rhine and finishes all (step s320) processings, if processing of all Rhine is not completed.
[0037] Thus, according to the gestalt of this operation, each concentration difference of the attention pixel 121 and the contiguity pixel 125,126 is computed. When at least one concentration difference is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. Since the threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section is set up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel

121 is not the edge section and it is made to perform binary-ized processing Generating of the dot of the pixel concerned in case the attention pixel 121 is the edge section is promoted, and the edge repeatability of a binary image improves.

[0038] In addition, in the gestalt of this operation, although the contiguity pixel 125,126 is considered as right and left of the attention pixel 121, you may be the upper and lower sides. That is, the contiguity pixels 125,126 should just be two pixels which adjoin the attention pixel 121 and sandwich this attention pixel 121.

[0039] Moreover, the value of the threshold used in the gestalt of this operation is shown as an example of the numeric value which can be taken, and is not restrained by these values.

[0040]

[Effect of the Invention] According to this invention, as mentioned above, the threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section Since it sets up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section and is made to perform binary-ized processing The effective effectiveness of becoming possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section, and to aim at improvement in the edge repeatability of a binary image is acquired.

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TECHNICAL FIELD

[Field of the Invention] This invention is applied to a printer, a scanner, a copying machine, facsimile, etc.; and relates to the image-processing approach which reproduces multiple-value image information as a binary image.

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PRIOR ART

[Description of the Prior Art] As one of the approaches which changes a multiple-value image into a binary image, the error diffusion method is known widely.
[0003] Drawing 5 is the block diagram showing the circuit which performs the conventional error diffusion method. The multiple-value data D of the attention pixel 121 which performs binary-ized processing from an image memory 100 in this drawing are read, and gamma amendment of is done to the multiple-value data according to the printing property of output equipment, such as a printer, with reference to the amendment data stored in the gamma amendment ROM 101. By the adder 102 of the error diffusion-process section 107, the error data E in this attention pixel 121 are added, and, as for multiple-value data D' of which gamma amendment was done, F=D'+E is outputted.
[0004] The data F of the attention pixel 121 to which error data were added are compared with the binary-ized threshold Th in a comparator 104, in F>=Th, binary-signal B="1" is outputted, and when it is F<Th, binary-signal B="0" is outputted. And binary-ized error E' at the time of binary-ized processing is computed as E'=F-B' by the subtractor 106 from this output.
[0005] Here, it is set to B'=Bx255 when input data is 256 gradation (0-255). It follows, for example, when the threshold of D= 230 and binary-izing is Th=128, it is B= 1, and as for the binary-ized error E, input multiple-value data are set to E=D-Bx255=230-1x255=-25. [of the output data after binary-izing]

[0006] In order for the predetermined error matrix Mxy to distribute this binary-ized error E in the weighting error computing element 105 to the data of a pixel processed after this, it is stored in the error memory 103, and is added to the multiple-value data of degree pixel with an adder 102, and propagation of error data is performed.
[0007] although [namely,] input multiple-value data are D= 230 in an example -- receiving -- binary-izing -- the comparison result of threshold Th=128 and the output data after binary-izing are 1, and since they are set to 255 in 256 gradation, the error of 25 produces them to 230 of the input multiple-value data D. Therefore, the error 25 over the input multiple-value data D= 230 is made into a binary-ized error, error distribution are carried out to the error memory 103 of an unsettled pixel with the weighting error computing element 105 using an error matrix, and this error is made to reflect in the binary-ized processing by subsequent pixels.
[0008] Here, an example of the error matrix Mxy used in the conventional error diffusion method is shown in drawing 6 .
[0009] In drawing 6 , the pixel shown by * is the present attention pixel 121, and suppose that binary-ized processing is performed to this pixel.
[0010] An error is distributed to degree unsettled pixel by the weighting multiplier (7, 1, 5, 3) which showed the error produced when this attention pixel 121 is made binary in this drawing. And it amends to the following input value which read the error allocation value stored in the error memory 103 when performing binary-ized processing of the attention pixel 121 shown by *, and was read from the image memory 100 using this error allocation value.
[0011] Thus, an error diffusion method is an approach of the binary-ized error produced in the case of

binary-ized processing of a certain pixel being henceforth distributed to the binary--ization-processed pixel data, and pressing down the error of image data and the original multiple-value image data to min after binary-izing.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, as mentioned above, the threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section Since it sets up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section and is made to perform binary-ized processing The effective effectiveness of becoming possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section, and to aim at improvement in the edge repeatability of a binary image is acquired.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the image which performed binary-ized processing by such error diffusion method, the repeatability of the edge section of the image made binary poses a problem on the property to distribute an error to a perimeter pixel. That is, in the attention pixel 121, since a part of information on a surrounding pixel is added, dotage occurs in the edge section of an image.
[0013] As conventional approach about this technical problem, edge enhancement processing by a high-pass filter etc. is performed to the original multiple-value data, and the method of raising the shelf life of an edge is used.
[0014] However, since the new problem that filtering influences the whole image and image quality deteriorates occurs according to this, there is nothing for fundamental solution very much.
[0015] Then, this invention aims at offering the image-processing approach that improvement in the edge repeatability of the binary image after error diffusion process can be aimed at.

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MEANS

[Means for Solving the Problem] In order to solve this technical problem, the image-processing approach of this invention Determine the attention pixel 121 and two contiguity pixels 125,126 which adjoin this attention pixel 121 and sandwich this attention pixel 121 are determined. Each concentration difference of the attention pixel 121 and two contiguity pixels 125,126 is searched for. When at least one concentration difference of two concentration differences is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. The threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section is set up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section, and binary-ized processing is performed.
[0017] It becomes possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section by this, and to aim at improvement in the edge repeatability of a binary image.
[0018]
[Embodiment of the Invention] It is the image-processing approach which invention of this invention according to claim 1 performs binary-ized processing to a multi-tone pixel, and generates a binary image. Determine the attention pixel 121 and two contiguity pixels 125,126 which adjoin this attention pixel 121 and sandwich this attention pixel 121 are determined. Each concentration difference of the attention pixel 121 and two contiguity pixels 125,126 is searched for. When at least one concentration difference of two concentration differences is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. The threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section It is the image-processing approach of setting up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section, and performing binary-ized processing. It has an operation of becoming possible to promote generating of the dot of the pixel concerned in case the attention pixel 121 is a pixel of the edge section, and to aim at improvement in the edge repeatability of a binary image.
[0019] Hereafter, the gestalt of operation of this invention is explained using drawing 4 from drawing 1. The block diagram showing a circuit for drawing 1 to perform the image-processing approach which is the gestalt of 1 operation of this invention, the explanatory view showing the pixel detected as the edge section in the image-processing approach that drawing 2 is the gestalt of 1 operation of this invention, the explanatory view showing a setup of the threshold in the binary-ized processing in the image-processing approach that drawing 3 is the gestalt of 1 operation of this invention, and drawing 4 are the flow charts which show the procedure by the image-processing approach which is the gestalt of 1 operation of this invention.
[0020] The multiple-value data D of the attention pixel 121 which performs binary-ized processing are

read from an image memory 100, and gamma amendment of is done to the multiple-value data according to the printing property of output devices, such as a printer, with reference to the amendment data stored in the gamma amendment ROM 101 so that it may illustrate. After edge detection processing is performed by the edge detection processing section 108 in which, as for the multiple-value data of which gamma amendment was done, the attention pixel 121 detects whether it is the edge section, a threshold is determined in the threshold decision processing section 109 of the error diffusion-process section 107. Moreover, the error data in the attention pixel 121 are added by the adder 102.

[0021] The data of the attention pixel 121 to which error data were added are compared in the threshold and comparator 104 which were determined in the threshold decision processing section 109, and a predetermined binary signal is outputted. And the binary-ized error at the time of binary-ized processing is computed by the subtractor 106 from this output.

[0022] In order for the predetermined error matrix Mxy to distribute this binary-ized error in the weighting error computing element 105 to the data of a pixel processed after this, it is stored in the error memory 103, and it is added to the multiple-value data of degree pixel with an adder 102, and propagation of error data is performed.

[0023] Here, in the case of the binary-ized processing in the attention pixel 121, the edge detection processing section 108 is for this pixel to detect whether it is the edge section, and outputs the information on whether the attention pixel 121 is the edge section based on the multiple-value data in the contiguity pixel 125,126 of attention pixel 121 right and left. In addition, about the detection procedure of the edge section, it mentions later.

[0024] Moreover, since this attention pixel 121 is saved as the edge section when the attention pixel 121 is detected by the edge detection processing section 108 as the edge section in the attention pixel 121, the threshold decision processing section 109 sets up the threshold for binary-izing as for which a dot becomes is easy to be struck.

[0025] Next, detection of an edge and preservation are explained using drawing 2 . The image of the multiple-value data which perform binary-ized processing in drawing 2 is shown, and this multiple-value data is expressed by the data of 256 gradation (0-255). And the 128 pixel concentration 123 and a pixel 124 make [a pixel 120 and the contiguity pixel 125 / concentration 0, the 121 pixel attention pixel 122, and the contiguity pixel 126] concentration 250 concentration of each pixel in this drawing.

[0026] Here, the pixels which should be detected as the edge section are the 121 pixel attention pixel 123 and a pixel 124, and are pixels which generate a dot and should save an edge by the image after binary[in this pixel]-izing. Moreover, the contiguity pixel 125 and the contiguity pixel 126 are pixels of the right and left which adjoin the attention pixel 121, and concentration is referred to in order to compute a concentration difference with the right-and-left pixel in the attention pixel 121 in the case of detection processing of an edge.

[0027] Next, detection of whether this attention pixel 121 is the edge section is explained. the concentration difference of the contiguity pixel 125 which is [data / of the attention pixel 121 / concentration] the contiguity pixel 125,126 on either side in D3 and the attention pixel 121 about the concentration data of D2 and the contiguity pixel 125 in the concentration data of D1 and the contiguity pixel 125 here, and the contiguity pixel 126 -- each, if DL and DR A concentration difference with the left contiguity pixel 125 in the attention pixel 121 and the concentration difference with the right contiguity pixel 126 serve as DL=D1-D2DR=D1-D3, respectively. And when the fixed value S with this value is exceeded, the attention pixel 121 is detected as the edge section. That is, when either DL>S or DR>S is materialized, this attention pixel 121 is detected as the edge section.

[0028] Next, the dot generating control at the time of detecting the attention pixel 121 as the edge section is explained.

[0029] In the pixel detected as the edge section, edge repeatability improves by promoting generating of a dot according to concentration. And it is possible to promote generating of a dot by changing the threshold at the time of the binary-ized processing by the pixel detected as the edge section, and gathering the incidence rate of a dot.

[0030] Such processing is explained using drawing 3 . Here, drawing 3 (a) and (b) show the relation of

ON/OFF of the dot by the concentration of image data and a setup of a threshold at the time of error diffusion process.

[0031] Generally, as shown in drawing 3 (a), the binary-ized threshold in the case of binary-izing by the conventional error diffusion is set about [middle] to 128 to the input concentration of 256 gradation, and is fixing this. However, with the gestalt of this operation, as shown in drawing 3 (b), a dot-on field is extended by lowering the binary-ized threshold in the pixel detected as the edge section to 96, it carries out that it is easy to generate a dot in this pixel, dot generating in the edge section is made [many], and edge repeatability is raised.

[0032] It explains referring to the flow chart of drawing 4 about such binary-ized processing. In drawing 4 , one line of the multiple-value data of an image which performs binary-ized processing is first stored in an image memory 100 (step s200), and the error data distributed to the pixel of this Rhine next are stored in the error memory 103 (step s210). And while reading the concentration data D1 of the pixel which performs binary-ization from the data for one line, adding the weighting error in this pixel and acquiring attention pixel 121 data, it changes into the amendment data corresponding to this pixel data from the gamma amendment ROM 101 (step s220).

[0033] Next, in the edge detection processing section 108, the concentration data D2 and D3 in the pixel of the right and left which adjoin the attention pixel 121 are acquired from an image memory 100 (step s230), and DL=D1-D2 and DR=D1-D3 which are the concentration difference of the concentration data D1 of the attention pixel 121 and the concentration data D2 and D3 of a right-and-left pixel are computed (step s240).

[0034] And the concentration differences DL and DR and the set point S which were acquired are compared (step s250), and from the set point S, when the concentration difference DL or the concentration difference DR is size, it detects this pixel as the edge section in the threshold decision processing section 109, and it performs a lower setup in a threshold as 96 (step s270). on the other hand -- both the concentration difference DL and the concentration difference DR -- although -- from the set point S, when it is smallness, a threshold is left 128 as fields other than the edge which is not the edge section (step s260).

[0035] Thus, after setting up a threshold, binary-ized processing by the error diffusion in this attention pixel 121 is performed (step s280), and processing by this pixel is ended.

[0036] And it judges whether the above-mentioned processing was completed to all the pixel of current Rhine (step s290). If it has not ended, it progresses to the following pixel and step s280 is performed from step (step s310) s220. Moreover, if it has ended, it judges whether the processing to all Rhine was ended (step s300), and the above processing will be repeated until it goes to next Rhine and finishes all (step s320) processings, if processing of all Rhine is not completed.

[0037] Thus, according to the gestalt of this operation, each concentration difference of the attention pixel 121 and the contiguity pixel 125,126 is computed. When at least one concentration difference is larger than the predetermined set point, the attention pixel 121 is made into the pixel of the edge section. When a thing [any] concentration difference is smaller than the predetermined set point, the attention pixel 121 is made into the pixel which is not the edge section. Since the threshold at the time of binary-ized processing in case the attention pixel 121 is a pixel of the edge section is set up lower than the threshold at the time of the binary-ized processing in the case of being the pixel whose attention pixel 121 is not the edge section and it is made to perform binary-ized processing Generating of the dot of the pixel concerned in case the attention pixel 121 is the edge section is promoted, and the edge repeatability of a binary image improves.

[0038] In addition, in the gestalt of this operation, although the contiguity pixel 125,126 is considered as right and left of the attention pixel 121, you may be the upper and lower sides. That is, the contiguity pixels 125,126 should just be two pixels which adjoin the attention pixel 121 and sandwich this attention pixel 121.

[0039] Moreover, the value of the threshold used in the gestalt of this operation is shown as an example of the numeric value which can be taken, and is not restrained by these values.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the circuit for performing the image-processing approach which is the gestalt of 1 operation of this invention
[Drawing 2] The explanatory view showing the pixel detected as the edge section in the image-processing approach which is the gestalt of 1 operation of this invention
[Drawing 3] The explanatory view showing a setup of the threshold in the binary-ized processing in the image-processing approach which is the gestalt of 1 operation of this invention
[Drawing 4] The flow chart which shows the procedure by the image-processing approach which is the gestalt of 1 operation of this invention
[Drawing 5] The block diagram showing the circuit which performs the conventional error diffusion method
[Drawing 6] The explanatory view showing the error matrix used in the conventional error diffusion method
[Description of Notations]
121 Attention Pixel
125 Contiguity Pixel
126 Contiguity Pixel

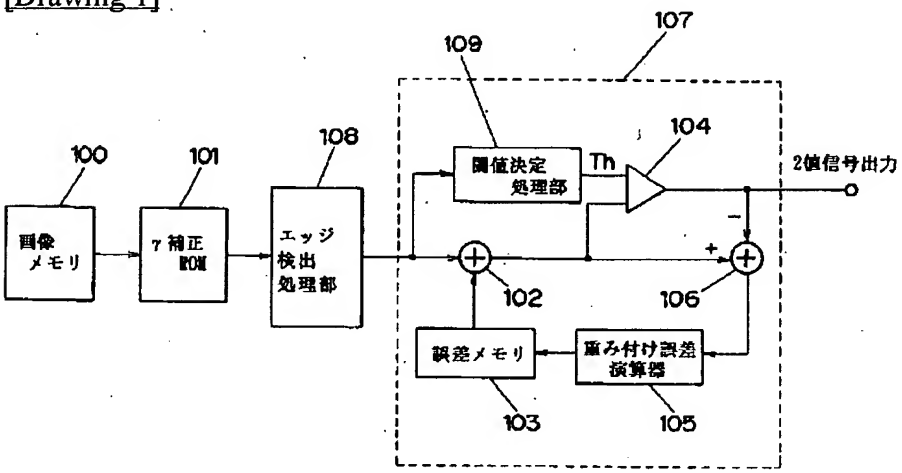
[Translation done.]

* NOTICES *

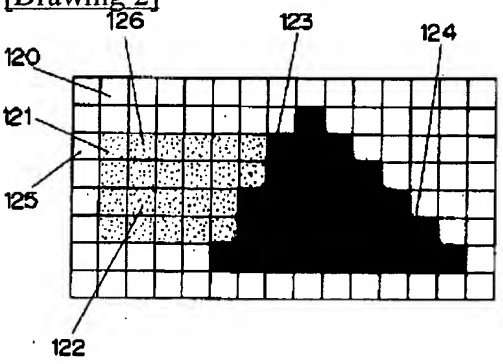
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

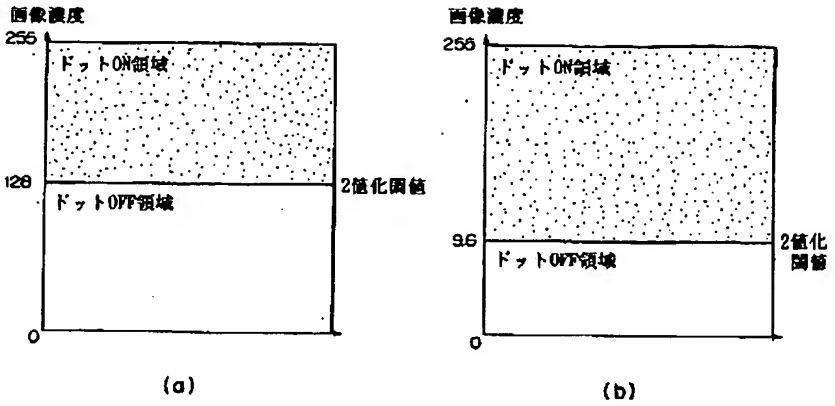
[Drawing 1]



[Drawing 2]



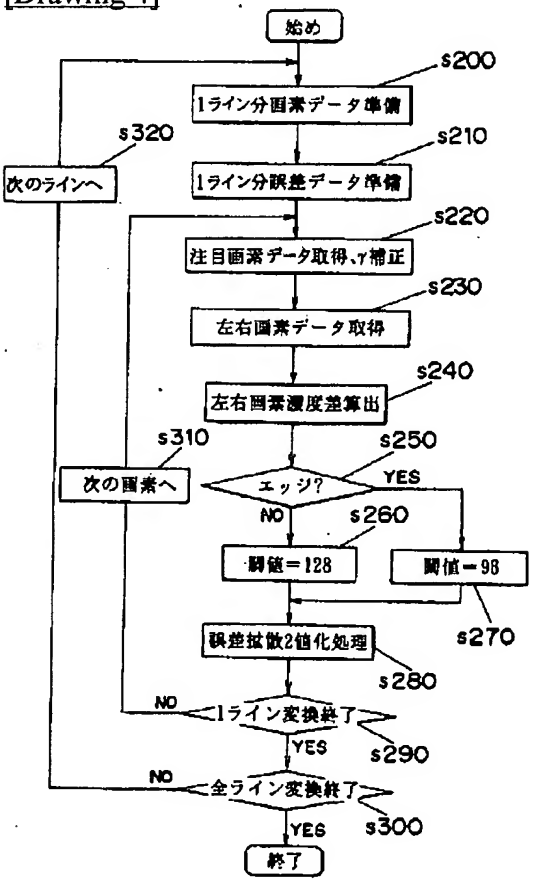
[Drawing 3]



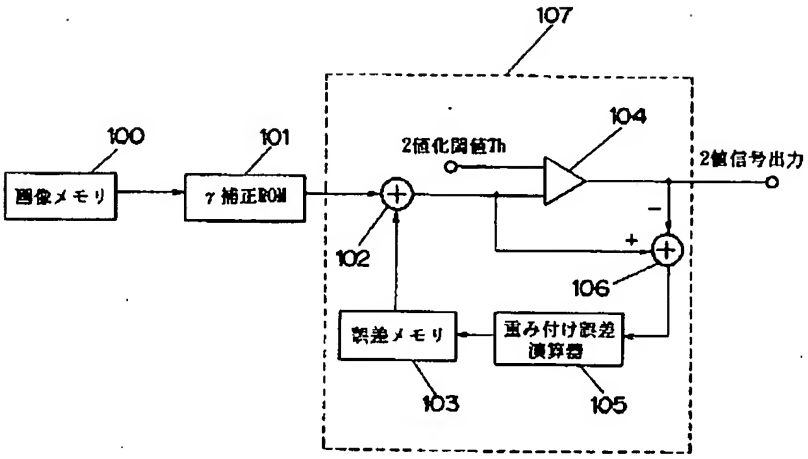
[Drawing 6]

	*	7
1	5	3

[Drawing 4]



[Drawing 5]



[Translation done.]